

REMARKS

The Office Action dated December 21, 2001, has been carefully considered. In response to the Office Action, Applicants have amended the application. Applicants request that the Examiner consider the following remarks, and then pass the application to allowance.

Drawing Corrections

The drawing figures have been corrected in accordance with the Examiner's suggestions. Specifically, Figs. 3A, 3B, 6A and 6B have been amended to indicate exemplary layer thicknesses as required by the Examiner. No new matter has been added. Approval of the corrections is respectfully requested.

Pending Claims:

Claims 1-14 remain pending.

Rejection Under 35 U.S.C. § 112, Second Paragraph

Claim 10 was rejected under 35 U.S.C. § 112, second paragraph, as indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention.

The meaning of the term "load," as used in the claims is equivalent to "loading", which is commonly used in the electrical and optical technical fields.

In the optical technical field, the term "load" or "loading" is conventionally used to refer to a complex dielectric substance (refractor) which is able to change the phase of a laser.

No limitation will apply to the materials of a load as long as it functions as a

✓ complex dielectric substance. If the imaginary part of electric constant of the complex dielectric substance is positive, it acts as an ordinary dielectric substance, while if the imaginary part is negative, it behaves as a metal substance. In addition, the real part of electric constant of the complex dielectric substance is small, it becomes transparent, while if the real part is large, it absorbs light.

Accordingly, a load behaves as a light reflector, a transparent layer, or a light absorber, depending upon the situation.

On page 5, lines 11 to 14, of the written description, the "load" is described as a member to change the effective refractive index of the surface of the recording medium. In other words, load is used to control the effective refractive index of the medium. There is no limitation for material of the load as long as it changes the effective refraction index.

According to the present invention, the load usually has a rectangular cross-section, and an array of loads forms convexities on the surface of a substrate to which they are attached. Applicant respectfully submits the meaning of the term "load" is clear from the specification, and the indefiniteness rejection thereof should therefore be withdrawn.

Art Rejection Under 35 U.S.C. § 103(a)

Claims 1, 2, 4-9 and 11 were rejected under 35 U.S.C. § 103(a) as unpatentable over Shimokawa, et al. (U.S. Pat. No. 5,702,793) in view of Nakamura, et al. (U.S. Pat. No. 4,690,861). This rejection also appears in the Office Action July 25, 2001 (paper No. 3), and Applicants' arguments in response thereto in the subsequent Amendment and Reply to Office Action dated October 25, 2001 (paper no. 5), were deemed unpersuasive.

In support of this rejection, the Office Action states that while Shimokawa, et al. does not specify the types of layers used in the multi-layer recording medium, "[t]he ability of having a spinel ferrite recording layer as part of a MO recording medium is acknowledged by the reference to Nakamura et al." (¶ 4) The Office Action further states:

[i]t would have been obvious to one of ordinary skill in the art to modify the system of Shimokawa, et al. with the teaching from Nakamura et al motivation is to provide for an appropriate under-reflecting layer of the material specified in claim 1 to provide for appropriate signal reflection from the reflective under layer.

Applicants respectfully disagree. The underlayer in Shimokawa, et al. is not used for "appropriate signal reflection" and is not an "under-reflecting layer," and mere "ability of having a spinel ferrite recording layer as part of a mo recording medium" does not rise to the proper level of motivation required to establish a *prima facie* case of obviousness. While the purpose of the underlayer of Shimokawa, et al. is not expressly defined,¹ Shimokawa, et al. is directed to reducing medium noise originating in the underlayer, and increasing the writing density therein. In order to attain these goals, Shimokawa, et al. applies reverse sputtering to the underlayer to reduce its thickness and flatten its surface before applying the recording layer thereon.

Nakamura, et al. discloses a recording device which does not use a garnet ferrite recording layer at all, but uses in its stead a hexagonal magnetoplumbite-type metal oxide magnetic substance. The recording performance of this magnetoplumbite layer is enhanced by providing an additional layer—spinel ferrite—which is tailored to compensate for the drawbacks accruing from the selection of the magnetoplumbite layer as the recording layer. These drawbacks include undesirable changes in crystalline orientation, and therefore magnetic recoradability, imposed by the presence of other required layers, including the substrate layer supporting the magnetoplumbite layer.

There is no teaching or suggestion in either of Shimokawa, et al. or Nakamura, et al. that the garnet recording layer of Shimokawa, et al. can be combined with the spinel ferrite layer of Nakamura, et al. The garnet recording layer of Shimokawa, et al. requires

¹In introducing the underlayer, Shimokawa, et al. merely states that "the garnet formed on the glass substrate is a polycrystalline film [(that is, it is multilayered, including an underlayer)] inevitably." (Col. 1, lines 37-40) No reason for this inevitability is provided, and the need for the underlayer is therefore not explained.

a garnet underlayer, not a spinel ferrite layer, and Shimokawa, et al. is dedicated to facilitating the efficient and practicable use of this garnet underlayer in conjunction with the garnet recording layer. One of ordinary skill in the art would not be motivated to eschew its use in favor of the spinel ferrite layer of Nakamura, et al. as there is simply no suggestion to do this, and as its function and design, as discussed at length in Shimokawa, et al. are integral to the operation of the garnet recording layer in the specific manner contemplated by Shimokawa, et al. This function and design, contrary to the assertion in the Office Action, are unrelated to reflectivity, and are rather more intimately involved in controlling the grain size of the molecules comprising the garnet recording layer, and thereby improving the recording density of the composite device.

Similarly, the spinel ferrite layer of Nakamura, et al. is specifically tailored to the requirements imposed by the molecular characteristics of the magnetoplumbite layer, and to address the drawbacks imposed by the structure and behavior of the magnetoplumbite layer when used as a recording medium. These drawbacks are not common to the garnet recording layer used in Shimokawa, et al., and one of ordinary skill in the art would therefore not be motivated to use the spinel ferrite layer of Nakamura, et al. with the garnet recording layer of Shimokawa, et al.

Importantly, neither Shimokawa, et al. nor Nakamura, et al. recognize the problem of undesirable internal compressive stress which occurs in a garnet ferrite recording layer when it is formed by sputtering. Failing to recognize this problem, and to address it by proposing to rely on the tensile stress of the spinel ferrite (or reutite-type oxide, or hematite layer) to cancel the compressive internal stress in the garnet ferrite recording as recited in the amended claims, wherein it is stated in Claim 1 for example that "the garnet ferrite recording layer is formed adjacent to the underlayer after the formation of the underlayer, thereby reducing the internal compressive stress of the garnet ferrite layer by the tensile stress provided from the underlayer," Shimokawa, et al. and Nakamura, et al. offer no motivation to combine their teachings. Absent such motivation, a rejection based on the

combination of Shimokawa, et al. and Nakamura, et al. is improper, and withdrawal of same is respectfully requested.

Claims 3 and 12 were rejected under 35 U.S.C. § 103(a) as unpatentable over Shimokawa, et al. in view of Nakamura, et al. as applied to Claim 1, and further in view of JP 5-303776. Claim 3, and Claim 2 from which it depends, recite tracks between which lie layers comprised exclusively of garnet ferrite. This configuration corresponds FIGS. 17, 18A and 18B of the specification, and serves to ensure that undesirable compressive stress in the heat-treated garnet ferrite layer will further decrease due to the division of the recordable garnet ferrite into separate tracks having relatively smaller width. Furthermore, the separation of garnet ferrite recording layer will result in a desirable fine morphology which cannot be achieved using conventional amorphous metal. In addition, the signal-to-noise ratio of the recording medium is increased due to the use of separate tracks having distinct compositions, said distinct compositions ensuring that the tracks will accordingly not interfere with each other magnetically. Hence, it will be appreciated that the use of the tracks of Claim 3 is not merely to facilitate tracking, but also to improve device performance from both the fabrication and the storage/magnetization standpoints. Such improvements are neither taught nor suggested by the prior art of record, and for this reason, as well as the reasons discussed above regarding the impermissibility of the combination of Shimokawa, et al. and Nakamura, et al., Claims 2 and 3 are patentably distinct over Shimokawa, et al. and Nakamura, et al., and passage of same to allowance is earnestly solicited.

Claims 13 and 14 were rejected under 35 U.S.C. § 103(a) as unpatentable over Shimokawa, et al. in view of Nakamura, et al. as applied to Claim 1, and further in view of Terao, et al. In support of this rejection, the Office Action states:

The ability of having heat treatment for the manufacturing of MO record media is acknowledged by the Terao et al reference. Such treatment is considered part of the manufacturing steps required.

As to the specific values recited in these claims, although no such value(s) is found in Terao et al, such limitations are considered to me merely optimization of system parameters and obvious to those of ordinary skill in the art. The temperature range/value for the heat treatment would be evaluated in order to yield an optimum manufacturing result. No unexpected results are seen to occur from such optimization.

Applicants respectfully disagree. The heat treatment process and the temperature ranges selected and recited in Claims 13 and 14 are not merely the result of optimization parameters of a known or obvious manufacturing process. Rather, the heat treatment and temperatures are chosen with a view to selectively endow desired magnetic properties only in the garnet ferrite writable layer, to the exclusion of other parts of the medium, such as the inter-track portions, to thereby reduce noise caused by cross-talk in the MO medium (see for instance p. 7, lines 5-17; pages 29-31; and FIG. 19). To that end, attention is directed to the discussion of Embodiment 14, wherein it is stated that during processing "the temperature of heat treatment was set at 630°C, whereby magneto-optical properties were provided only to the garnet ferrite layers 3a [(FIG. 17)] on the spinel ferrite layers 2." ✓
Thus while the garnet ferrite portions 3a lying on the spinel ferrite layers 2 were endowed with magneto-optical properties due to the selective heat treatment, the inter-track garnet ferrite portions 3b lying between the portions 3a, which, remarkably, are of identical material composition, did not acquire the magneto-optical properties, and therefore in operation would not become magnetized and contribute to undesirable cross-talk. Such behavior, it is respectfully maintained, is neither taught nor suggested by Terao, et al., which discloses different layer compositions unrelated to the magneto-optical devices of the present invention and dissociated from the unique properties and requirements thereof. ✓

The Office Action states that a restriction requirement would be appropriate if the Applicants maintain that the heating and temperature range limitations of Claims 13 and 14 are other than mere optimization parameters. Applicants respectfully take issue with this position, since the art cited in support of the rejection of Claims 13 and 14—namely, Terao, et al.—does not disclose the use of the materials of Claims 13 and 14 and base Claim 1. As such, there is no basis for the assertion that the temperature and range values for the materials of these claims are merely matters of optimization. Accordingly, Applicants maintain that the heating and temperatures claimed are unobvious over the cited prior art, and are unobvious over the materials claimed.

Art Rejection Under 35 U.S.C. § 102(b)

Claims 1, 2, 4, 5, and 9-12 were rejected under 35 U.S.C. § 102(b) as anticipated by either EP 196,332; JP 60-150,614; JP 60-107,815; JP 60-200,887; WO 8502292; or Gomi, et al. (U.S. Pat. No. 4,608,142). It is respectfully submitted that all of these prior art references are related and correspond to each other as different publications relating to the same invention. Accordingly, the following discussion with the respect to the Gomi, et al. patent applies to all these references. *okay*

Gomi, et al. discloses the use of a layer of TiO_2 (rutile-type oxide) 9 as a protective layer formed over a thin film 6 of $(\text{Y,Bi})_3(\text{Fe,Al})_5\text{P}_{12}$ disposed on a substrate 7. The TiO_2 is provided to inhibit loss, or out-diffusion, of material such as Bi from the thin film 6 during an annealing process performed during fabrication. It also serves to reduce surface roughness caused by the annealing process. ✓

By comparison, Claim 1 of the presently-claimed invention recites that the garnet ferrite layer is provided with an "*underlayer* selected from the group consisting of a spinel ferrite layer, rutile-type oxide layer, and a hematite layer." (Emphasis added) Claim 1 further recites that "the garnet ferrite recording layer is formed adjacent to the underlayer *after* the formation of the underlayer, *thereby reducing the internal compressive stress of* ✓ ✓

the garnet ferrite layer by the tensile stress provided by the underlayer." (Emphasis added) //

The recited structure, and specifically, the manner in which it is achieved, provides a stable device in which undesirable compressive stress of the garnet ferrite recording layer is canceled by the tensile stress provided by the underlayer. Accordingly, higher density, higher resolution and lower noise results. Moreover, while in the recited structure the spinel ferrite layer, rutile-type oxide layer, or hematite layer are used as an underlayer, in Gomi, et al., the TiO₂ is used as a protective layer which is applied after the recording layer is formed. The presently claimed structure thus realizes a more stable and robust device. In Gomi, et al., the problem of increased compressive stress is not addressed—rather, the concern in Gomi, et al. is to maintain a high Bi concentration, and to that end, Gomi, et al. proposes the use of the protective TiO₂ layer to reduce the Bi out-diffusion during annealing. ✓

Claims 1, 2, 4, 6-8 and 11 were rejected under 35 U.S.C. § 102(b) as anticipated by Machida, et al. (U.S. Pat. No. 4,608,142).

Machida, et al. discloses a magento-optical recording medium having a first magnetic layer and a second magnetic layer. As one of the examples of the first magnetic layer material, iron garnet ferrite is listed (see column 2, lines 57-58). Furthermore, as one of examples of the second magnetic layer material, cobalt spinel ferrite is listed (see column 2, line 59).

However, it is clear that these specific materials are merely cited as elements of lists, and that a specific combination of garnet ferrite layer and cobalt spinel ferrite layer is not disclosed or suggested in Machida. ✓
disagree

It should be noted that the material of the first magnetic layer may not only be iron garnet ferrite but also magnetoplumbite hexagonal ferrite or cobalt spinel ferrite, and that material of the second magnetic layer may not only be cobalt spinel ferrite but also nickel spinel ferrite.

Furthermore, there is no specific example in Machida consisting of an iron garnet ferrite layer and a cobalt spinel ferrite layer. } none claimed

In addition, it should be noted that the second magnetic layer in Machida is used as a laser beam absorbing layer (see column 4, lines 16-19) to make recordings at lower temperature possible, while the present invention uses a spinel ferrite layer, rutile-type oxide layer or a hematite layer as the underlayer of the garnet ferrite recording layer.

Furthermore, Machida does not disclose or suggest the necessity to reduce the internal compressive stress in the recording layer. The purpose (easy overwriting; see column 4, lines 20-21) of the prior art of Machida has nothing to do with that of the present invention (that is, to cancel the internal compressive stress in a garnet recording layer).

In fact, Machida does not disclose or suggest that a garnite ferrite recording layer should be formed adjacent to an underlayer (spinel ferrite, rutile-type oxide or hematite layer) after the formation of the underlayer.

As a result, it is clear that the present invention according to the amended claims is not anticipated by Machida et al., and withdrawal of the rejection based on Machida et al is respectfully requested.

Conclusion

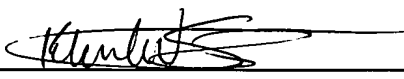
In view of the preceding discussion, Applicants respectfully urge that the claims of the present application define patentable subject matter and should be passed to allowance. Such allowance is respectfully solicited.

Application Serial No. 09/529,919
Attorney's Docket No. 032590-055

If the Examiner believes that a telephone call would help advance prosecution of the present invention, the Examiner is kindly invited to call the undersigned attorney, Mr. Khaled Shami, at (650) 622-2332.

Respectfully submitted,

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Marked-Up Copy of Changes

In the Claims

Claims 1, 12, 13, and 14 have been amended as follows:

1. (Amended) A magneto-optical recording medium having a recording layer and a reflective layer on a substrate characterized in that the recording layer has a layered structure in which a garnet ferrite recording layer, and at least one underlayer for the garnet ferrite recording layer selected from the group consisting of a spinel ferrite layer, rutile-type oxide layer and a hematite layer are layered, wherein the garnet ferrite recording layer is formed adjacent to the underlayer after the formation of the underlayer, thereby reducing the internal compressive stress of the garnet ferrite layer by the tensile stress provided from the underlayer.

12. (Amended) A magneto-optical recording medium according to [Claims] Claim 11, wherein grooves are formed on the surface of said transparent layer.

13. (Amended) Manufacturing method of a magneto-optical recording medium having a recording layer and a reflective layer on a substrate, the recording layer having a layered structure in which a garnet ferrite recording layer, and at least one underlayer for the garnet ferrite recording layer selected from the group consisting [any one] of a spinel ferrite layer, rutile-type oxide layer and [or] a hematite layer are layered, characterized by comprising the steps of:
forming said underlayer on said substrate, heat-treating the underlayer, forming said garnet ferrite recording layer adjacent to the underlayer, [recording layer], and
heat-treating the garnet ferrite [formed] recording layer at a temperature of 500 to 700°C,
thereby reducing the internal compressive stress of the garnet ferrite recording layer by the tensile stress provided from the underlayer.

14. (Amended) Manufacturing method of a magneto-optical recording medium having a recording layer and a reflective layer on a substrate, the recording layer having a layered structure in which a garnet ferrite recording layer, and at least one underlayer for the garnet ferrite recording layer selected from the group consisting of a spinel ferrite layer, rutile-type oxide layer and a hematite layer are layered on tracks on which data are recorded, characterized by comprising the steps of:
forming said underlayer on said substrate,
heat-treating the underlayer,

forming said garnet ferrite recording layer adjacent to the underlayer, and
[according to Claim 13, wherein the] heat-treating the garnet ferrite recording layer
[is performed] at a temperature of 600 to 630°C,
thereby reducing the internal compressive stress of the garnet ferrite recording layer
by the tensile stress provided from the underlayer, and magneto-optical properties are
provided only to the tracks.

FIG. 3A

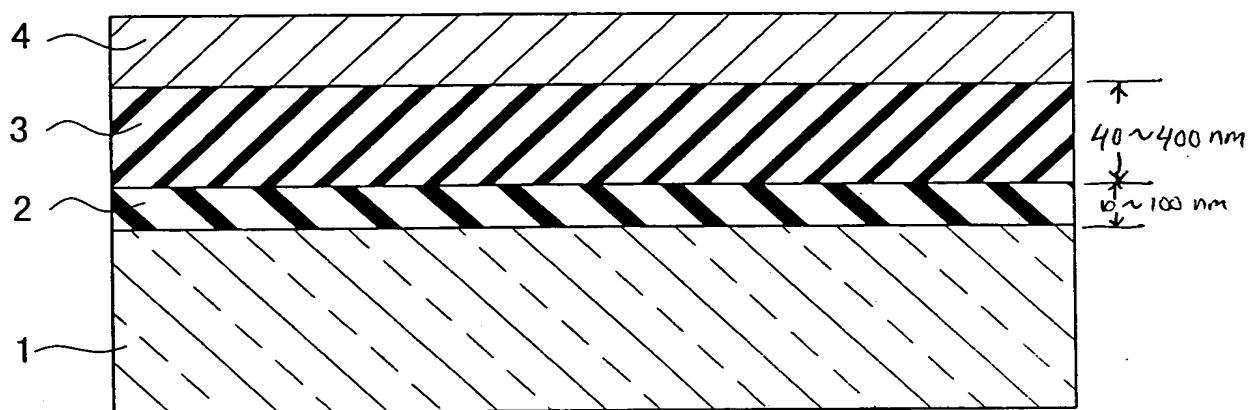


FIG. 3B

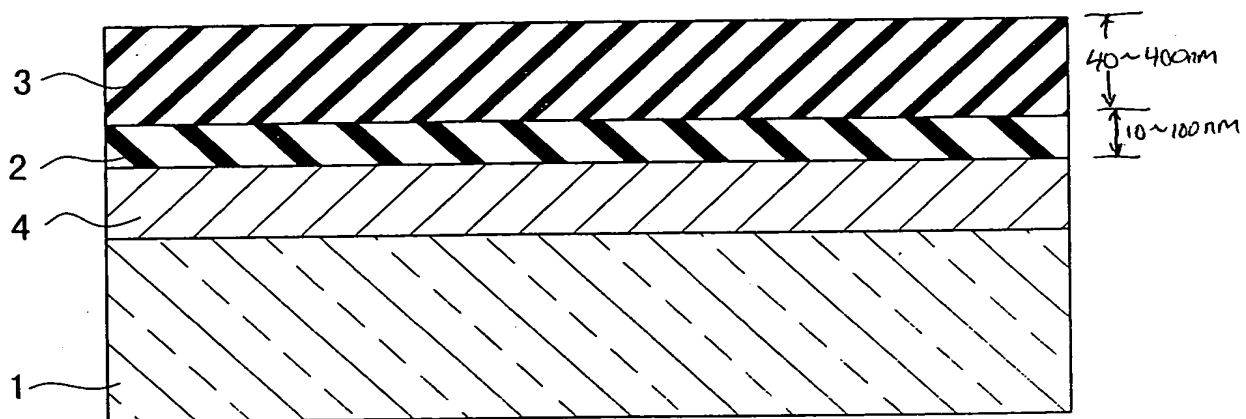


FIG. 6A

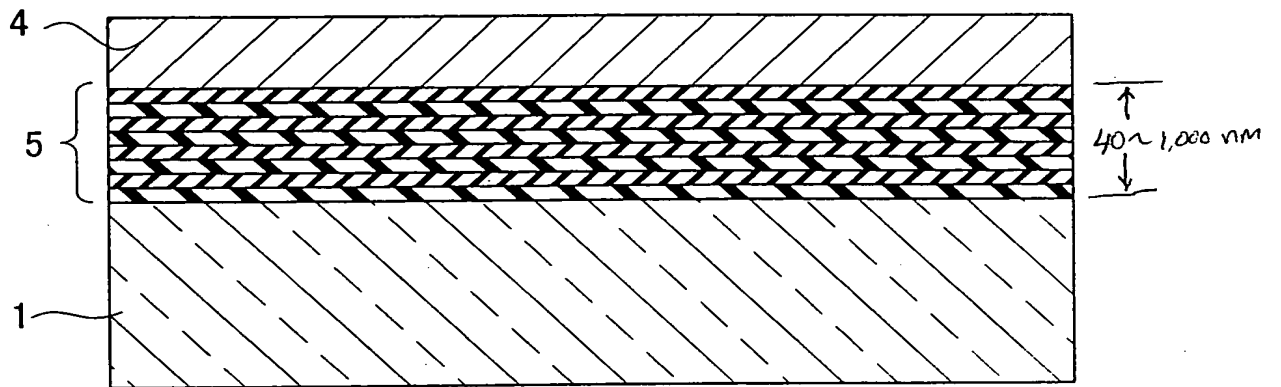


FIG. 6B

